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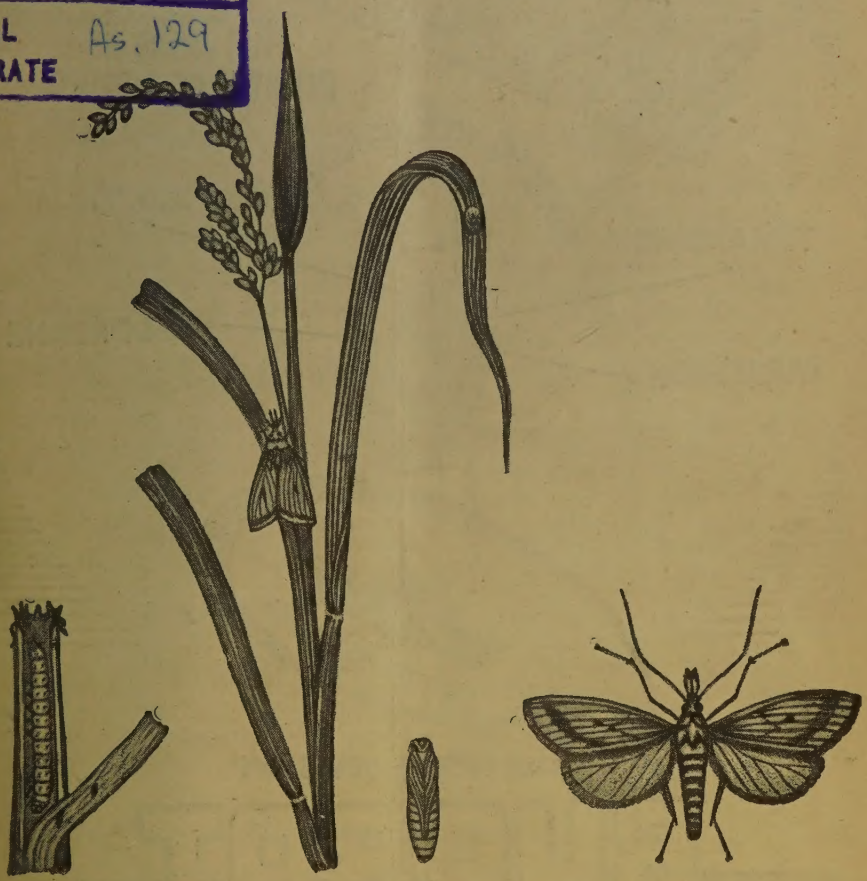

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ADMINISTRATION AND ORGANIZATION OF PLANT PROTECTION IN BOMBAY STATE

By

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and

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In recent years, the emphasis on insect and disease control has increased many-fold. This has been partly due to the popularity Entomologists have attained after the advent of the inexpensive and effective organic insecticides and partly due to the increased attention drawn towards extension methods in agricultural departments all over the country. At the same time, in no small measure, the country-wide development of organized plant protection work has been due to the interest and initiative of Dr. H. S. Pruthi, Plant Protection Adviser to the Government of India.

In Bombay State the research sections of Entomology and Plant Pathology have been in existence for over several decades ; along with these, there have been a few important efforts towards plant protection, particularly in the control of betelvine wilt, cotton wilt, "Koleroga" disease of betelnuts and the control of spotted boll worms of cotton. However, an unified extension side of these two subjects came into organized existence only in 1948, by the establishment of a State Crop Protection Scheme. As the *modus operandi* of this scheme is of current interest, an attempt is made here to present the existing set-up and to describe some of the early endeavours made to promote insect and disease control in Bombay State. The work of plant protection is also carried out by other special schemes as a part of the State Extension Programme and hence the relationship of State Crop Protection Scheme with such projects is also discussed. The details of work done will, however, form the matter for a subsequent communication.

Aims and Objects of Plant Protection Scheme :

1. To increase pest and disease control consciousness through demonstrations, charts, exhibitions, circulars, etc.
2. To conduct and organize training classes in plant protection technique for district extension staff.
3. To organize pest and disease intelligence service in a manner that no time is lost in reporting the outbreak of pests or diseases.

4. To render prompt and cheap plant protection service in the State.
5. To make available the necessary insecticides, fungicides and appliances.
6. To co-ordinate the work of other plant protection schemes of the State.
7. To promulgate domestic quarantine measures.

Staff :

The staff of the Crop Protection Scheme consists of one Crop Protection Officer, 4 Agricultural Officers (Crop Protection Scheme), 30 Agricultural Assistants, one Junior Clerk and 5 Peons. Their grades are as follows :

1. Crop Protection Officer in Bombay Agricultural Service Class II Rs. 220—15—400—E.B.—20—500—E.B.—25—650.
2. Agricultural Officers (graduate) in the grade of 210—10—300.
3. Agricultural Assistants (non-graduate) in the grade of Rs. 55—3—85—E.B.—4—125—5—140.
4. Junior clerk in the grade of Rs. 46—3—85—E.B.—4—125—5—130.
5. Peons in the grade of Rs. 30—½—35.

Finance :

The budget sanctions from the beginning of the Crop Protection Scheme were as stated below. These were contributed equally by the Government of India and the State Government. These figures are exclusive of the other plant protection schemes operating in the State for specific insect pests and diseases.

TABLE 1.—*Budget provisions for Crop Protection Scheme, Bombay State*

Period of the scheme	Pay and allowances of staff	Capital expenditure	Contingencies	Total
1948-49	90,380	96,250	13,000	1,99,630
1949-50	96,584	..	13,500	1,10,084
1-9-50 to 28-2-51	50,331	36,258	9,025	95,614
1951-52	90,700	36,258	22,100	1,49,058
1952-53	83,447	..	20,600	1,04,047

Administrative and Technical Control :

In earlier times when extension and research administrations were not distinct there were considerable delays in attending to the urgent calls for technical aid on plant protection sent to the departmental headquarters. From this experience, it has been realized that if the technical assistance is to reach the farmer in a short time, the principal guiding factor in administration of plant protection, particularly in a large State like Bombay should be that a certain amount of decentralization is essential. Along with this, there has also been a consciousness that liaison between research and extension is equally important. It is relevant to point out here that in such advanced countries like the United States of America, the Extension Entomologist and Extension Plant Pathologist attached to the respective research staff provide the link between the research and the extension organizations. In the Bombay State, the staff of the Crop Protection Scheme, provide this invaluable link.

During the initial implementation of the State Crop Protection Scheme, the Plant Pathologist to Govt. was in charge of the scheme. However, as the problems to be dealt with are more of Entomological nature, later on, the Crop Protection Officer has been under the administrative control of the Agricultural Entomologist to Govt. and consequently the latter looks after the administrative work of the Scheme. The Crop Protection Officer has to tour in the State about three weeks in each month so that greater output of work can be obtained from all the staff. Further, he is under the supervision and guidance of the State Plant Pathologist and the Agricultural Entomologist in all matters pertaining to their respective subjects, and is stationed at Poona.

The headquarters of the four Agricultural Officers (CPS) are scattered over the State to achieve the decentralization emphasized earlier. Their headquarters and jurisdiction are as follows :—

Headquarters of the Agricultural Officers (CPS)	Jurisdiction
Baroda	Banaskantha, Sabarkantha, Amreli, Ahmedabad, Panchmahals, Kaira, Baroda, Broach and Surat districts.
Nasik	East & West Khandesh, Nasik, Thana, Bombay Suburban, Kolaba districts.
Poona	Poona, Satara (N), Ahmednagar, Sholapur and Bijapur districts.
Dharwar	Belgaum, Dharwar, Ratnagiri and N. Kanara.

These four officers are under the administrative control of the District Agricultural Officers of the district in which their headquarters are located. Like the Crop Protection Officer, they are also under the technical control of the Agricultural Entomologist and Plant Pathologist while the work is carried out through the offices of the respective District Agricultural Officers. Any District Agricultural

Officer can call the respective Agricultural Officer (CPS) when there is immediate need for technical assistance and when control measures are to be organized. The Crop Protection Officer can also be called for similar purpose.

The propriety of vesting in the District Agricultural Officer, the administrative control of Crop Protection Staff is often questioned; however, it has been found by experience, that such an arrangement results in orderly work and prompt action. With the existence of genuine and willing co-operation of the District Agricultural Officers, who after all have full and direct interest in the extension programme, either pertaining to seed distribution or insect and disease control, there has been little difficulty in the smooth running of the Crop Protection work in the State. It may be further stated that the district extension officer has to utilize all his assistants for crop protection also, hence, the vesting of the authority in them for crop protection is even more pertinent.

Besides the Agricultural Officers (CPS) there are 30 non-graduate Agricultural Assistants and their distribution is generally one per district as in Ahmedabad, Panchmahal, Broach, Surat, Sholapur, Bijapur, Ratnagiri and Karwar, while there are two assistants in the districts of Kaira, Thana, Kolaba, East & West Khandesh, Nasik, Poona, Satara (N), Ahmednagar, Belgaum and Dharwar. The newly merged areas are not yet provided with any agricultural assistants but this phase of development of the scheme is under consideration.

Role of Other Extension Staff in the Districts:

When one considers the scope of a Crop Protection scheme there is a frequent tendency to relegate the other extension staff to the background. However, their role in Crop Protection work is by far the most vital. The creation of special posts of assistants for plant protection alone, for each taluka or groups of villages, is hardly justifiable and at the same time, the Crop Protection information can never reach the general public through the few assistants under the State Crop Protection Scheme proper. Thus the major burden of this work at the taluka and village level will have to continue to be on the agricultural assistants of the general agricultural extension service of the State. In the Bombay State there is an extensive organization to undertake extension work in agriculture and their share of extension work concerning plant protection is undeniably maximum, though a discussion of that organization is not germane to this article.

Dissemination of Technical Information:

The departmental extension service leaflets are the chief source of information for the public. They are published periodically and revised with advancement of research and are distributed gratis. Besides these, special Crop Protection circulars are issued periodically. These circulars pertain to the most immediate problems which arise from time to time. The Crop Protection circulars have become an essential auxiliary to the departmental leaflets, as they can be cyclostyled at short notice and can be distributed quickly. On the basis of these circulars special small leaflets in regional languages are issued from the grants of Rural Development Boards of some districts.

So far the following circulars have been issued :—

1 Jassid Hopper (*Idiocerus* sp.) and Mildew on Mango and their control.

2. Desert Locust (*Schistocerca gregaria*) and its Control.

3. Paddy Blue Beetle (*Leptispa pygmoea*) and Blast Disease Control.

4. Jassid (*Empoasca* sp.) Control on Cotton.

5. Field Rat Control.

6. Control of some Cotton Pests.

7. Control of Swarming Caterpillar (*Spodoptera mauritia*).

Before the inception of the Crop Protection Scheme, the exhibitions either for the State as a whole or at the district level, were generally attended by the research staff. Due to the limited time and finance at their disposal, many of the shows were left unattended. After the State Crop Protection Scheme came into existence, this phase of extension work has been entirely taken over by them and it forms their normal duty.

Training of Staff :

The extension staff particularly the agricultural assistants are not necessarily familiar with the problem of insect and plant disease control, hence, it has been necessary to impart to them the training in this subject. The programme of the scheme includes the training of all the officers of the scheme in both Agricultural Entomology and Plant Pathology and they are made to attend refreshers' classes conducted periodically by the research staff of the Plant Pathologist to Government and Agricultural Entomologist to Government, Bombay State, Poona. Such training brings their knowledge upto-date and enables them to face technical problems with confidence and keeps them abreast with the advancement of research.

The programme of training for the agricultural assistants during the past two years, mainly centred around locust control as the staff had to be particularly active in this regard. Thus in 1951-52, every agricultural assistant either of general extension staff or of Crop Protection Scheme of about a dozen northern districts of the State were fully trained in the locust control work. Classes were conducted in the regional languages by officers specially trained in locust control methods. In the second phase of this State-wide programme every agricultural assistant of the State is to be trained in plant protection. Special classes already are under way wherein technical knowledge of insecticides, fungicides, appliances and the information on the major insect pest and plant disease problems of their area are imparted.

Distribution of Insecticide and Fungicide :

One of the chief problems in the extension work associated with Crop Protection is to make insecticides and fungicides available at short notice in remote places. Not all the commercial distributors of

insecticides and fungicides have their branch depots everywhere. Some of them, however, have extensive sales organizations, but, devoid as they are of the technical information on the proper use of these materials, they render little technical service. Persons with knowledge can utilize these commercial facilities but in times of emergency, the district extension staff is approached by the public to make the insecticide or fungicide available, as other sources are not known to them. The problem of distribution of these chemicals, is, therefore, to utilize whatever facilities are locally available from the commercial sales organizations and secondly to provide additional assistance through the Crop Protection Scheme wherever there is a likelihood of the other facilities not being adequate.

As to the former, the policy has been to keep a grant with each of the District Agricultural Officers, who operate it under the Personal Ledger Account. If there is a sudden demand, the District Agricultural Officer can utilize this grant for local purchase of insecticides and fungicides and make them available to the cultivators in remote places on no-loss-no-profit basis. Further, such bulk purchases are sometimes sold by the dealers at concession rates, which benefit naturally then accrues to the cultivators. This procedure is particularly useful in times of emergency when the District Agricultural Officer can take action on his own initiative. Besides the grants available with the District Agricultural Officer, the Director of Agriculture of Bombay State, Poona, also has specific grants for the purpose as a part of the Crop Protection Scheme. Annually certain most commonly needed insecticides and fungicides which are assured of a quick sale are purchased and distributed for sale on no-loss-no-profit basis and the recovery of charges for this material is naturally entrusted to the District Agricultural Officers who control the stocks of districts.

In certain schemes for protection against specific insect pests and diseases, the Government, by a special order, permits free or concessional use of insecticides and fungicides. Thus during the past few years insecticides and fungicides were given free of cost for the Blue beetle and the Blast disease control, the Desert locust control, Crab control and the "Koleroga" control schemes and for the Deccan wingless grasshoppers and Surface grasshopper control, BHC was made available at concessional rate. For the Deccan wingless grasshopper, initially the insecticide was sold at 1/3 the total cost, the other 2/3 was borne equally by the Government of Bombay and the Union Government. Later, half the actual cost was charged to the cultivator and now it is sold at 10 per cent less than the market rates.

In all cases the district extension staff utilizes the proper insecticides and fungicides, because, for specific maladies, they have to consult the research staff as to the chemicals to be used, their concentration and rates at which they are to be applied.

Distribution of Appliances:

The urgency of demand for appliances goes parallel to the requirements of insecticides and fungicides but unlike the latter, they cannot be had at short notice. Hence the equipment is to be kept

distributed all over the districts and the State as a whole. The hand-operated appliances are generally rented at Rs. 0-4-0 per day except when special sanction is given by the Government for their free use as in the State Anti-Locust scheme.

In distributing the appliances the guiding factor has been the demand. Thus in the areas vulnerable to locust infestation, large number of plunger type dusters and power dusters are kept while in the southern districts liable for epidemic of grasshoppers greater number of rotary dusters are provided and so on.

In the Bombay State as a whole a large number of appliances have been made available either from State Plant Protection Scheme or from other schemes with similar aims ; and these are listed district-wise in table 2.

It has been estimated that on an average there are about five dusters and two sprayers per taluka while the averages per district are 47 dusters and 21 sprayers. Though the average figures appear rather low, the position is considered satisfactory as not in all places in a district the appliances are required to be in use and the excess can be adjusted according to requirements within a district. In times of special emergency, however, inter-district adjustments sometimes become necessary.

Relation with Other Schemes for Control of Particular Pests and Diseases :

The Crop Protection Scheme does not envisage that it can look after the actual extension work for serious and wide-spread epidemics of periodical nature. Thus though the Crop Protection Scheme could render technical assistance and act as a liaison between research and extension staff for locust control it can hardly be expected that such an extensive problem like the control of the Desert locust could be fully carried out by them unaided. Thus for certain specific pests

TABLE 2.—*Distribution of appliances in the Bombay State*

Serial No.	Name of the districts	Sprayers	Dusters	Power dusters	Flame throwers
1	Palanpur	43	122	1	21
2	Sabarkantha	17	78	1	12
3	Mehsana	52	133	3	25
4	Amreli	23	34	1	12
5	Ahmedabad	25	117	2	13
6	Kaira	26	20	1	7
7	Baroda	17	24	..	5
8	Godhra	16	20	..	22

TABLE 2.—*Distribution of appliances in the Bombay State*—contd.

Serial No.	Name of the districts	Sprayers	Dusters	Power dusters	Flame throwers
9	Broach	14	25	..	5
10	Surat	33	35	..	5
11	Dangs (Ahwa)	13	15	..	5
12	Thana	17	33	1	5
13	Kolaba	21	12	..	5
14	Nasik	20	30	..	5
15	Jalgaon E. K.	21	26	..	5
16	Dhulia W. K.	18	26	1	6
17	Ahmednagar	18	26	..	..
18	Poona	14	28	1	..
19	Sholapur	14	25	..	..
20	Satara (N)	20	22	..	..
21	Satara (S)	14	25	..	..
22	Kolhapur	13	22	..	..
23	Ratnagiri	20	30	..	..
24	Belgaum	25	178	1	..
25	Bijapur	16	90	1	..
26	Dharwar	22	70	1	..
27	Karwar	15	27	1	..
	Total ..	568	1,292	15	137

and diseases, due to the pressing problem of conservation of food crops Government often considers it essential that more facilities are needed for their control and hence sanctions free distribution of insecticides and free use of appliances in the form of schemes for control of specific pests.

These special problems are considered temporary in nature and consequently the schemes pertaining them are also of short duration. Such schemes not only serve the purpose of saving the valuable food crops, but also serve as demonstration schemes which inculcate in the farmers the idea that though the control of pest and disease appears unsurmountable, timely human endeavours can check them. So far there have been the following special extension schemes for pest and diseases control.

1. State Anti-locust scheme (*Schistocerca gregaria*).

2. Scheme for control of Blue beetle (*Leptispa pygmoea*) and Blast disease.
3. Scheme for control of Crab on paddy in Deccan.
4. Scheme for "Koleroga" disease control on areca nut.
5. Scheme for control of Deccan wingless grasshopper (*Colemania sphenarioides*) in Karnatak and Maharashtra.

These schemes often have full compliment of staff, insecticides and appliances. Thus in the State Anti-locust Scheme there have been 11 graduates, 44 assistants, 4 clerks, 16 drivers, 11 peons and 3 mechanics and a large stocks of insecticides and appliances. In the "Koleroga" Control Scheme the staff consisted of one graduate and a few assistants. While for the remaining no significant staff was proposed but provision for insecticides, fungicides and appliances were made. Some of these schemes came into existence even prior to the State Crop Protection Scheme and hence all the work was done by extension staff in consultation with the research staff. However after the starting of the State Crop Protection Scheme, the technical work of these schemes was looked after by the State Crop Protection staff under the technical guidance of the research staff, while the extension work was done by the district staff.

The staff of the special schemes is also put under the administrative control of the District Agricultural Officers. Thus in the State Anti-locust Scheme and the "Koleroga" Control Scheme, the additional staff which was provided worked along with the other extension staff.

The State Crop Protection Scheme staff act as a stand-by and continue to attend the usual work. However, the Crop Protection Officer and Agricultural Officers (CPS), Baroda, provided the technical facilities like training the locust officers and other staff while the Agricultural Entomologist looked after the organizational side of the State Anti-locust Scheme. It may be pointed out here that in the first year of the working of the State Anti-locust Scheme, due to inadequacy of resources in the State Anti-locust Scheme, all the Crop Protection staff was used for extension work of locust control and they saved the situation which would otherwise have gone out of control.

A mention is necessary as to the existence of Crop Protection Staff in Sugarcane Development Scheme. This consists of one Crop Protection Officer (EAS Class II) with headquarters at Ahmednagar who has under him one non-graduate agricultural assistant, a clerk and a "mukadam". They work under the Sugarcane Specialist, at Padegaon, as a part of the over-all Sugarcane Development plan subsidized by the Indian Central Sugarcane Committee. The other staff of Sugarcane Specialist also do extension work of sugarcane crop protection. The Crop Protection Officer of the scheme, if and when necessary consults the research staff.

One other organisation dealing with plant protection is the Gun Club. These are voluntary local efforts encouraged by the State Government and helped in many ways. They are mainly looked after by Revenue Department.

INSPECTION AND GRANT OF PHYTOSANITARY CERTIFICATES IN RESPECT OF PLANTS OR SEEDS INTENDED FOR EXPORT.

According to Government of India, Ministry of Food and Agriculture (Agri.) notification No. F.9-55/51-Dte. I, dated 21st September, 1951, the following officers are authorized to inspect and to grant health certificates in respect of plants and seeds intended for export to foreign countries, the Governments of which require a certificate of freedom from insect pests and diseases to accompany the consignments of plants and seeds :—

Central Government

(i) The Plant Protection Adviser to the Government of India, Ministry of Food and Agriculture, New Delhi.

(ii) The Head of Division of Entomology, Indian Agricultural Research Institute, New Delhi.

(iii) The Head of Division of Mycology, Indian Agricultural Research Institute, New Delhi.

(iv) The Forest Entomologist, Forest Research Institute, Dehra Dun.

(v) The Forest Mycologist, Forest Research Institute, Dehra Dun.

(vi) The Deputy Director (Plant Diseases), Directorate of Plant Protection, Quarantine and Storage, New Delhi.

(vii) The Assistant Director (Foreign Quarantines), Directorate of Plant Protection, Quarantine and Storage, New Delhi.

Part 'A' States

Assam

(i) The Director of Agriculture, Assam.

(ii) The Director, Tea Experiment Station, Toklai.

Bihar

(i) The Entomologist to the Government of Bihar, Department of Agriculture, Bihar.

(ii) The Mycologist to the Government of Bihar.

Bombay

(i) The Plant Pathologist to the Government of Bombay, Poona.

(ii) The Agricultural Entomologist to the Government of Bombay, Poona.

Madras

(i) The Entomologist to the Government of Madras, Coimbatore.

(ii) The Mycologist to the Government of Madras, Coimbatore

Madhya Pradesh

(i) The Mycologist to the Government of Madhya Pradesh.

(ii) The Entomologist to the Government of Madhya Pradesh.

Uttar Pradesh

(i) The Plant Pathologist to the Government of Uttar Pradesh, Kanpur.

(ii) The Entomologist to the Government of Uttar Pradesh, Kanpur.

West Bengal

(i) The Entomologist to the Government of West Bengal.

(ii) The Mycologist to the Government of West Bengal.

Punjab (I)

(i) The Entomologist to the Government of Punjab (I).

(ii) The Plant Pathologist to the Government of Punjab (I).

Orissa

The Director of Agriculture, Orissa.

Part 'B' States

Travancore-Cochin

The Director of Agriculture, Travancore-Cochin.

Hyderabad

(i) The Entomologist. (ii) The Plant Pathologist.

Mysore

The Director of Agriculture.

Madhya Bharat

The Director of Agriculture, Gwalior.

Jammu & Kashmir

The Director of Agriculture.

P. E. P. S. U.

(i) The Director of Horticulture.

(ii) The Commissioner for Agriculture.

Saurashtra

The Director of Agriculture.

Part 'C' States

Bhopal

The Director of Agriculture.

Ajmer

The Agricultural Officer.

Coorg

The Agricultural Officer.

Part 'D' States

Andaman & Nicobar Islands

The Agricultural Officer.

Other States

Sikkim

The Forest Manager, Sikkim.

ARTICLE V OF INTERNATIONAL PLANT PROTECTION CONVENTION

Article 5 of the International Plant Protection Convention, to which India has become a signatory, states as follows :—

1. Each contracting Government shall make arrangements for the issue of phytosanitary certificates to accord with the plant protection regulations of other contracting Governments, and in conformity with the following provisions :

   (a) Inspection shall be carried out and certificates issued only by or under the authority of technically qualified and duly authorized officers and in such circumstances and with such knowledge and information available to those officers that the authorities of importing countries may accept such certificates with confidence as dependable documents.

   (b) Each certificate covering material intended for planting or propagation shall be as worded in the Annex to this Convention and shall include such additional declarations as may be required by the importing country. The model certificate may also be used for other plants or plant products where appropriate and not inconsistent with the requirements of the importing country.

   (c) The certificates shall bear no alterations or erasures.

2. Each contracting Government undertakes not to require consignments of plants intended for planting or propagation imported into its territories to be accompanied by phytosanitary certificates inconsistent with the model* set out in the Annex to this Convention.

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* The model certificate has already been published in the Plant Protection Bulletin, Vol. IV, No. 3.

SOME EXPERIMENTS ON THE CONTROL OF THE RICE STEM BORER (*SCHOENOBIUS INCERTELLUS* WALKER) AND THE RICE MEALY BUG (*RIPERSIA ORYZAE* GREEN).

By

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Assistant to the Government Entomologist, Coimbatore

Introduction :

The Rice stem borer (*Schoenobius incertellus* Walker) has been reckoned as one of the major problems, practically all over the Far East. This borer, lays eggs on the leaf tips in small masses, covered with buff-coloured hairs and the caterpillars, on hatching, bore into the stem and kill the central shoot.

Broadly speaking, the trends of the pest are as follows in double cropped areas in Tanjore District. A major emergence of the adults occurs soon after the harvest of the short crop by October. The nurseries of the second crop, being ready by about this time, the oviposition is concentrated on the seedlings. The caterpillars eventually hatch out and infest the young plants and kill a good many of them. The next major emergence of the moths occurs by about the time when the main crops are in shot-blade in November-December. The progeny of this brood infests the plants in due course and gives rise to the characteristic white ears, the Thaladi crop generally having the worst of it. While these are the broad trends, a considerable number of minor emergences do occur throughout the season, indicating the over-lapping of the broods. Most of the infested plants contain a larva in each. The extent of damage has been recorded to vary from year to year, and from place to place. Though a maximum of 54 per cent. has been recorded in certain areas, the average is estimated to be somewhere about 5—10 per cent.

A few hymenopterous parasites have also been reared out from the egg and larval stages but attempts to exploit these biological agencies for the control of the pest, have not been, so far, successful. A fund of information on the habits with reference to the incidence, range of flight, influence of weather factors on the pest population, etc., has also been gathered.

The solution of the more important aspect, *i.e.*, the control has, however, been as elusive as ever all these years. Various methods of control like hand-picking the egg-masses from the seedlings, elimination of infested plants, close cutting and burning of the stubbles, setting up of light traps, application of fertilisers, etc., have been tried. But none of them have at any time given appreciable degree of relief as to warrant their adoption, as definite measures of control. The recent advent of the highly potent synthetic insecticides gave us the necessary incentive to investigate the possibilities of adopting them.

The "Soorai" Disease of Paddy:

The insect responsible for this complaint is a mealy bug, *Ripersia oryzae* Green. It has practically a wide distribution in Madras State, often occurring fairly severe form in the Tanjore Delta. The details of the pest are briefly as follows:—The infestation occurs in the field in circular sunken patches, manifesting the peculiar depressions in the midst of a normal crop. The infested plants are dwarfed in size and sickly in appearance. An examination of the plants would reveal the presence of hundreds of the mealy bugs and their nymphs inside the leaf sheaths. These insects suck up the cell-sap and cause such a drain on the plant nutrition that the normal development is arrested. Such plants are unable to throw out their earheads and even in the few cases where the latter manage to come out, they are somewhat contorted in shape with most of the grains empty.

The bug breeds on a variety of wild grasses growing on the bunds during the off season. The initial infestation spreads from these grasses to the seedlings in the nurseries. The infested seedlings are inadvertently transplanted in the fields with the nucleus population of the bug. The pest later multiplies and spreads to the surrounding plants. There is also every reason to surmise that further infestation may take place from the field bunds as well. Considerable information on the life history and habits, alternative host plants, natural enemies, etc., of the bug is also available. Control methods have been under trial for the past two decades. The general principle underlying these was to exert some check on the preliminary infestation in the nurseries. Burning the grasses on the bunds before sowing and treating the bunds and seedlings with DDT and BHC were the methods attempted. But the results have not been conclusive, so far, partly due to the non-occurrence of the pest in a severe form during certain years and more due to the ineffectiveness of the methods themselves.

Material and methods.—Some of the recent chemicals like BHC, DDT, etc., were tried at different concentrations as a common measure against the stem borer, *Schoenobius incertellus* Walker and the mealy bug, *Ripersia oryzae* Green at the Agricultural Research Station, Aduthurai.

Regarding the stem borer, the object of the experiments was to see whether the application of chemicals brings about any appreciable reduction in the pest incidence either by their deterrent or lethal action, against the adults or by the residual lethal effects against the young caterpillars which hatch out of the egg masses. Four light traps were set up daily at the Farm to note the emergences and their magnitude so as to time the insecticidal sprays with the occurrence of the former. Having in view the evolution of a cheap and effective programme of control, only the two major broods occurring during the nursery and shot-blade stages were sought to be controlled, ignoring the minor ones.

As regards the mealy bug, the influence of the same variants on its incidence in the field was studied.

The stem borer (*Schoenobius incertellus* Walker) : 1950-51.—Five cents each of seedbeds of the Samba and Thaladi crops were sprayed, separately with 0.1 and 0.05 per cent of BHC and DDT, the Samba seedbeds once and the Thaladi twice, with an interval of a week. The treated seedlings were transplanted in separate plots of six cents each, replicated eight times in the case of Samba and nine times in the case of Thaladi. These plots were given a second treatment with the same chemicals during the shot-blade stage. Fortnightly counts of the deadhearts, were recorded in four plots, 25 square feet each, selected at random for each of the replications and control. The counts were commenced soon after the seedlings had established themselves and continued upto the harvest. The observations were purely exploratory.

1951-52.—The experiments were continued on a more elaborate basis with the following variants as sprays, *viz.*, (i) DDT 0.1 per cent and 0.2 per cent, (ii) BHC 0.05 and 0.1 per cent, (iii) HETP 0.1 per cent, (iv) Parathion 0.025 per cent. The area of the seed-bed for each treatment was five cents. Three rounds of the sprays were given to all the seedbeds at weekly intervals, commencing from the 15th day after sowing. Due care was taken to distribute the treatments in different nurseries, one sufficiently far away from the other, since most insects are likely to be deterred and scared away by the strong smell of BHC and DDT as well.

Due to the limited area under the Samba crop, the treated seedlings, were transplanted in 10 cent plots, each being separated from the next by a similar buffer area. In the case of Thaladi, the seedlings under each treatment were transplanted in plots of 40 cents each, located sufficiently far away from the other. A second spray with the same set of chemicals was given to the crops just before or during the shot blade stage, the treatments being timed with major emergences of the moths.

Fortnightly counts of the deadhearts, were taken for all the treatments in the Samba crop, in ten randomised plots each measuring 2 ft. × 2 ft. The yield figures for the various treatments were computed by harvesting similar plots for each.

A larger number of samples was, however, possible in the case of Thaladi, as the plots were more extensive. The area for each treatment was divided into six blocks (the longer side having three divisions and the shorter two) after leaving a three-foot border all round as outskirts. Six 2 ft. × 2 ft. plots were selected at random for each block in all making 36 four sq. feet samples for noting the progressive infestation.

Similar experiments were conducted at the Agricultural Research Station, Thirurkuppam also, so as to get some experience under different conditions. The variants were restricted to the DDT and BHC sprays and the crop was Samba planted by September and harvested by February 1952. The plan of work was on the same lines.

Ripersia oryzae : 1951-52.—As regards this mealy bug, the number of the characteristic patches and their extent, were recorded for the treated and control fields in both the crops.

Infested patches.—The possibility of controlling the pest after the development of the typical symptoms of infestation was attempted. The patches were marked out and treated with different concentrations of BHC, DDT, Parathion and HETP. Advantage was also taken of the recent availability of the systemic insecticide "Schradan" and a few observation trials were made with this preparation as well. All these treatments were given only once and the results observed for 24, 48 and 72 hours with regard to (i) bug mortality and (ii) expansion of the patches. It was also contemplated to see whether the infested plants recover their full vigour as a result of any of the treatments, but could not be observed as the trials with the higher concentrations, which alone had some effects on the bug, were taken up somewhat late in the season.

Results :

The rice stem borer (*Schoenobius incertellus* Walker) "*Samba and Thaladi*"—1950-51.—Only four variants were tried and fortnightly counts of the healthy and infested tillers were made throughout the season for the two crops to note the progressive infestation. The aggregate results are furnished in Statement I. The percentages of dead-hearts have ranged from 0.52 to 2.02 and 1.38 to 3.45 for the Samba and Thaladi crops respectively. The incidence has been lowest in the case of BHC 0.1 per cent and highest in the controls in both the crops.

1951-52.—There were in all six variants and counts were recorded for the whole season on similar lines. The aggregate figures are furnished in Statement II. The range of infestation has been 0.9 per cent to 3.3 per cent for the Samba and 2.5 per cent to 5.8 per cent for the Thaladi. As in the previous year, the number of the dead hearts has been least in the BHC 0.1 per cent plots and highest in the control.

The calculated acre yield figures for both the crops during 1951-52 under the different treatments are furnished in Statement II. No information of any interest is available from the above data which is mostly attributable to the low incidence of the borer.

Thirurkuppam.—The figures obtained at the Agricultural Research Station, Thirurkuppam are furnished in Statement III. The percentage of infestation has ranged from 0.71 to 1.30 and there is little or no variation in the yields.

The rice mealy bug (*Ripersia oryzae* Gr.).—The effects of the insecticidal washes applied at the nursery and shot blade stages were assessed in the case of the mealy bug only on Thaladi of 1951-52 as the pest was present only on this crop. The degree of infestation was recorded by counting the number of the sunken patches as well as their size. The details are furnished in Statement IV. Curiously

enough, the infestation has been the highest in BHC 0.1 per cent and lowest in Parathion. The control plots originally marked out have had only a very mild infestation, probably on account of some unavoidable delay in the planting of these fields. However, for purposes of a wider comparison, the average infestation on four bulk fields of the same variety is also furnished in the above statement. With these inevitable drawbacks, it is too early to hazard the reasons for the variations in the different variants and they can, at best, be taken only as indicative for further work.

Individual patches.—A large number of the sunken patches were treated with different concentrations of the chemicals. The results were observed 24, 48 and 72 hours after the treatment and the aggregate data for the total period are furnished in Statement V. Parathion 0.2 per cent has given the best results, both by way of high bug mortality and minimum expansion of the patches, BHC 0.4 per cent, HETP 0.4 per cent and the systemic insecticide—'Schradan'—0.75 per cent showing some promise of control. The experiments being purely exploratory, the results are only suggestive.

Conclusions :

The stem borer—*Schoenobius incertellus* Walker and the mealy bug—*Ripersia oryzae* Green—are serious pests of rice and freely occur all over the State but their incidence is somewhat sporadic.

The possibilities of control of these pests lie only in the lines attempted in this note, on account of the internal feeding habits of the two pests.

The incidence of the stem borer has been rather low this year and the results are indicative. The experiments have, therefore, to be continued and the methods given a fair trial during seasons of a more virulent incidence. The lines of work offer little promise against the mealy bug.

The results of spraying the individual patches with higher concentrations of Parathion, BHC, HETP and Schradan promise something fruitful.

From the experience gained so far, the method of lay out and assessment of the results appear to be capable of improvement and a more satisfactory technique is yet to be evolved. The object of the paper is only to present a short account of the work done and the tentative results obtained. The findings do not promise any immediate solution of the problems and are, at best, expected to serve a starting point for further investigations.

Acknowledgments :

The author is indebted to Sri S. Ramachandran, Government Entomologist for having planned out the work and guided the progress of the same from time to time and helped in the preparation of this note. The work at Thirurkuppam was kindly conducted by the Paddy Specialist for whom also thanks are due for having

permitted to incorporate the data in this paper. Thanks are also due to Sri. K. Ramaswamy, Superintendent of the Agricultural Research Station, Aduthurai, for his kind interest in the work and the facilities afforded.

STATEMENT I.

Table showing the percentage of Infestation of Stem borer—(1950-51).

Treatments	SAMBA			THALADI		
	Total No. of tillers examined	Total No. of infested tillers	Percentage of infestation	Total No. of tillers examined	Total No. of infested tillers	Percentage of infestation
1 DDT 0·05% spray ..	57,161	617	1·10	70,510	1,669	2·35
2 DDT 0·10% spray ..	57,243	504	0·88	70,809	1,317	1·85
3 BHC 0·05% spray ..	57,241	429	0·75	71,336	1,153	1·61
4 BHC 0·10% spray ..	57,288	298	0·52	71,223	993	1·38
5 Control	56,890	1,150	2·02	69,654	2,405	3·45

STATEMENT II.

Table showing the Percentage of Infestation of Stem borer and Calculated Yield for acre—1951-52.

Treatments	SAMBA				THALADI			
	Total No. of tillers examined	Total No. of infested tillers	Percentage of infestation	Calculated yield per acre	Total No. of tillers examined	Total No. of infested tillers	Percentage of infestation	Calculated yield per acre
				lb.				lb.
1. BHC 0·05% spray ..	4,318	75	1·70	6,602	18,316	692	3·80	4,386
2. BHC 0·10% spray ..	4,554	40	0·90	7,214	21,781	541	2·50	4,109
3. DDT 0·10% spray ..	4,618	129	2·80	5,649	19,451	1,009	5·20	3,932
4. DDT 0·20% spray ..	4,611	109	2·40	6,125	19,691	895	4·50	4,335
5. Parathion 0·025% spray ..	4,724	81	1·70	6,602	21,146	738	3·50	4,108
6. HETP 00·1% spray ..	4,540	87	1·90	7,128	21,470	821	3·80	4,108
7. Control	4,508	151	3·30	4,332	19,999	1,137	5·80	4,108

STATEMENT III.

Table showing the Percentages of Infestation of Stem borer—Tirurkuppam Samba—Co. 25.

Treatments	Total No. of tillers	Number of infested tillers	Percentage of infestation	Calculated yield per acre
				lb.
1. BHC 0·1% spray	5,528	39	0·71	2,080
2. BHC 0·05% spray	5,692	43	0·76	2,330
3. DDT 0·1% spray	4,877	64	1·30	2,190
4. DDT 0·2% spray	5,198	66	1·30	1,930
5. Control	5,345	44	0·82	2,070

STATEMENT IV.

Results of trials against "Soorai" combined experiment for Stem borer and "Soorai" trials.

Treatments	Number of Soorai Patches	Total area of Patches
		Sq. ft.
1. BHC 0·05% spray	29	187
2. BHC 0·10% spray	41	380
3. DDT 0·10% spray	19	195
4. DDT 0·20% spray	18	154
5. HETP 0·10% spray	8	93
6. Parathion 0·025% spray	6	51
7. Control (a) (Average of four bulk fields)	72	1,740
8. Control (b) Original control	10	87

STATEMENT V.

Table showing the percentage of mortality of Ripersia oryzae and increase in expansion to the original (1951-52).

No.	Treatments	Average mortality recorded at the end of 72 hours	Percentage of expansion over the original
1	BHC 0·1% spray	17·60	40·20
2	BHC 0 2% spray	23·60	15·50
3	BHC 0·4% spray	65·40	0·60
4	DDT 0·2% spray	12·90	52·40
5	DDT 0·4% spray	16·10	38·00
6	DDT 0·8% spray	49·00	10·60
7	Parathion 0·05% spray	29·00	9·20
8	Parathion 0·1% spray	55·20	0·40
9	Parathion 0·2% spray	70·50	nil
10	HETP 0·2% spray	20·90	25·40
11	HETP 0·4% spray	56·80	6·30
	SYSTEMIC INSECTICIDES		
12	Schradan 0·075% spray	15·70	39·00
13	Schradan 0·15% spray	27·10	27·80
14	Schradan 0·30 % spray	31·10	12·50
15	Schradan 0·50% spray	44·30	1·00
16	Schradan 0·75% spray	57·90	0·50
17	Control	2·10	52·30

PLANT PROTECTION AGAINST DISEASES IN PUNJAB (INDIA) *

By

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Plant Pathologist, Ludhiana

(i) Control of Loose Smut of Wheat

In view of the unusual seriousness of this disease in the wheat crop of 1951-52, extensive propaganda was done emphasising the importance of exploiting the 'Solar Heat Treatment' to eliminate infection from seed wheat to be sown during the next 'rabi' season. Lectures and demonstrations in respect of the actual method of treatment by solar heat were given at different places in the State. As a result of efforts made by the Plant Protection staff, District Work Staff and the staff working at the various departmental farms in the State, 12,944½ maunds of seed-wheat were freed from smut during May and June of the year under report. Such a large quantity of seed-wheat was never treated in the past in the Punjab. This quantity is sufficient to raise about 20,000 acres of wheat crop free from this disease. Even at a conservative estimate, the enhanced grain yield due to the elimination of Smut will amount to about a hundred thousand rupees.

(ii) Control of Earcockle or 'Mamni' Disease of Wheat

Instructions were issued to the Plant Protection Staff, District Work Staff and the staff working at the various departmental farms to combine the process of eliminating earcockle galls from seed-wheat while carrying out the solar heat treatment against loose smut. Earcockle galls, being lighter than water, floated to the surface during the process of soaking, were skimmed off from 5,587½ maunds of seed-wheat. In consequence of this treatment, yield of wheat grain is expected to be increased by about Rs. 50,000.

(iii) Control of Citrus Canker

The departmental nurseries at Jullundur and Attari were regularly sprayed with Bordeaux mixture after the careful removal and destruction of diseased leaves and branches. The Fruit Specialist, Punjab, sold only those nursery plants which did not show any visible citrus canker infestion.

The Plant Protection Staff of the State sprayed 24,912 citrus plants and 14 acres under citrus nursery, against this disease.

* Extract from the Annual Report of the Plant Pathologist, Punjab, for the year ending 30th June, 1952.

NOTES AND NEWS

Antibiotics Promising for Plant Diseases*

Antibiotics, a great help in the treatment of human diseases, might in the future, also be used to control plant diseases according to recent tests of the U.S. Department of Agriculture.

In exploratory experiments at the Plant Industry Station, Beltsville, Md., Dr. J. W. Mitchell, Dr. W. J. Zaumeyer and Powell Anderson have found the antibiotic, streptomycin sulphate, to be effective in controlling halo-blight, a bacterial disease of bean seedlings.

In their greenhouse experiments, the scientists applied minute amounts of 12 antibiotics as a thin layer of paste to the stems of bean seedlings. These were then inoculated with halo blight organisms. Apparently, the antibiotics were absorbed by the stems and moved up to the leaves in sufficient amounts to prevent growth of the organisms. But much more work on effectiveness and hazard is needed before any of the antibiotics can be recommended for practical disease control in the fields.

This preliminary work, however, demonstrates that some antibiotics can be taken into the plant by absorption through the tissues and will be spread through the plant. The findings demonstrating the control of a bacterial disease in plants by this means, open up a new approach to the control of plant diseases caused by bacteria, fungi and viruses.

Control of The Black Field Cricket (*Gryllulus commodus*)†

In experiments carried out by Mr. B. M. Braithwaite, Assistant Entomologist, New South Wales, for the control of these crickets, various bait mixtures given below have been successfully used :—

(1) DDT dust (50 per cent) 3 oz., bran 24 lb., molasses 4 lb. dissolved in 2½ gallons of hot water per acre ;

(2) BHC dust (20 per cent) 10 oz., bran 48 lb., water 2½ gallons, at 50 lb. per acre ;

(3) BHC dust (20 per cent) 10 oz., bran 48 lb., at 25 lb. per acre ;

(4) Chlordane ½ lb., kerosene 3-1/5 pints, bran 100 lb., at 5 lb. mixed bait per acre.

The baits were tested against a swarm of crickets destroying seedling turnip crops. The results, in all instances were promising, the best being obtained with (1), followed by (4), then with (2) and (3) which were equal.

Overseas results indicate that 0.5 per cent DDT, 0.1 per cent chlordane and 0.05 per cent BHC sprays are effective in control.

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*Extract from *National Agricultural Chemicals Association News*, Vol. 10, No. 3, page 4 (1952).

†Extract from the *Agricultural Gazette*, New South Wales, Vol. 63, Part 4, April 1952.

A New Enemy of Crops in Uttar Pradesh *

A new grass named 'chalmoda' is damaging the crops in the hill-districts of U.P. Replying to a questioner from Kumaon Division in the State Assembly, Shri Charan Singh, said that experts had advised the spraying of sodium chlorate in the fields to prevent the crops from being damaged. The efficacy of this and other methods to combat this new enemy of the crops, he said, was being tested.

Application of DDT to textiles†

Moth and carpet beetle attack may be prevented by the incorporation of DDT and other insecticides in the yarn or piece. Effective methods of impregnating the material are covered in a new patent (B.P. 650, 403) granted to the Geigy Company. The formula consisting of milk casein, borax, glacial acetic acid, xylene, oleic acid and water, is prepared and the DDT is added in a dispersed form to the extent of 10 per cent by weight. The mixture is kept at 70°-75°C. and is passed through a colloid mill; Wool in the form of piece, hank or cheese, dyed under acid conditions can be treated in this solution. When dyeing is complete, the dye liquor is run off and replaced with cold water. The DDT dispersion (2.5-3 per cent on the weight of wool) is then diluted with an equal part of cold water and added to the bath. Circulation of the pieces or the liquor for 10-20 min. causes the dispersion to exhaust on the wool being treated. The addition of Glauber's salt to the bath speeds the exhaustion. (The Dyer 105(12) : 771, 1951).

Third International Congress on Crop Protection

On September 15, 1952, the Congress opened in the Grand Amphitheatre of the Sorbonne under the Patronage of the President of France and the Presidency of Mons. Jean Lefevre, Director of the Institute Nationale Agronomigne with Mons. Willaune as the Chairman of the Organizing Committee.

M. Lefevre, opened the Congress and then followed a discourse by Prof. R. Fabre, Doyen of the Faculty of Pharmacy and Prof. of Toxicology in the University of Paris. Dr. Muller, the Nobel Prize-winner, read a paper on the Development of Phytopharmacy. He referred to the interference in the balance of nature caused by man's efforts and gave some striking figures of losses from insect attack—about £570 millions annually in the United States alone ! He quoted figures for the consumption of insecticides for 1951 in the U.S.A.: 58 million lb. of DDT, 65 million lb. of BHC, 400 million lb. of sulphur, 5 million lb. of pyrethrum, 3½ million lb. of Carbon tetrachloride and many more. He also gave figures of actual consumption and estimated requirements for DDT and BHC as a measure of malaria control in the countries of the eastern and western hemispheres.

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* Extract from the *Food Bulletin*, Vol. 7, No. 22 (September, 1952), page 6.

† Extract from the '*Science Newsletter*' No. 66, dated 22nd February, 1952, issued by the Scientific Adviser, office of the High Commissioner for India in London.

Special Congress lectures were delivered by M. M. Raucourt and Dupire on Hexachlorocyclohexane, M. Darpoux on Antibiotics in crop protection, Dr. Ripper on Systemic Insecticides and Prof. Chouard on Growth Promoting Substances in Crop Protection.

Pest Infestation Research in England*

The persistence of contact insecticides on brick surfaces, as likely to be found in warehouses, etc., has been studied in Britain. It is indicated that DDT wettable powder and dispersed products and a dieldrin wettable powder provide much longer insect toxicity (10 months or more) than gamma-BHC (35 days) or aldrin (2 to 4 months).

For the flour beetle (*Tribolium castaneum*) it has again been shown that a combination of pyrethrins and gamma-BHC gives control superior to that obtainable from the separate use of BHC. This favourable interaction was much less noticeable for other important store pests and not displayed at all for some, so it must be regarded as a specific rather than general synergism. Another synergistic action studied is that of piperonyl butoxide on pyrethrum ; this pronounced action has been confirmed for a range of store pests, but although toxicity to the pests, is enhanced its persistence does not seem to be increased, though this has been claimed in other studies.

A new Arsenical†

Arsenic has appeared in a new form in the armoury of insecticides. The product is compound A42, or —arsenomethane As.-1, 2 disulphide. Insect tests have shown that A42 has a very similar 4D-50 to that of DDT for beetle types ; it also appears that its phytotoxic effects are low. Dearth of information on animal toxicity tests is a major gap in the present data. A42 has a slight volatility and a little under 5 per cent. of its total *As* is water-soluble. These two properties suggest that there may be toxic hazards in handling and from residues left on crops.

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* Extract from *Manufacturing Chemist*, Vol. XXIII, No. 9, p. 379 (1952).

† *Ibid.*

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